

Theoretical Analysis of Axial Behavior of Circular Column Confined with Polymer Material

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Abstract

The collapse of the bridge are due to inadequate seismic performance of bridge pier (or pile) and columns, which provided with poor ductility and energy dissipation. Deep study of strengthening structural element concern elasto – plastic behavior of concrete would be important to increase the capacity of structures elements. Considering the rapid development of economic construction and the Traffic volume through different regions has been escalating, there is a substantial contribution has been developed in traffic construction and structures. This research focus on new strengthening method to provide effective confinement to the concrete core and obtain elastic deformation of the circular columns. The finite element software ABAQUS used for the nonlinear numerical analysis of the concrete column strengthening with polyurethane cement composite mix. Results shows that the use of new technique for strengthening has greatly improved the ultimate capacity of column. The thickness of strengthening material is the main parameters in this study and govern by the behavior of polyurethane-cement material. The improvement ratio in loading capacity with confinement thickness 40 mm and density of confinement material 1600 Kg/m³ is 277% compared with non-strengthening model.

Keywords: Column strengthening, nonlinear finite element, polyurethane-cement composite.

1. Introduction

Different studies have been investigated the external confinement for reinforced concrete column and the flexural behavior, flexural strength and ductility, and these researches has showed the importance of the resistance of sever seismic attacks [1, 2]. The commonly composite material used for retrofitting column or other structural element are Fiber Reinforced Polymer (FRP) , these types include carbon FRP (CFRP), aramid FRP (AFRP), steel FRP (SFRP), glass FRP (GFRP) and Basalt Fiber Reinforced Polymer (BFRP) composites are less frequently used. Different method of jacketing were applied to improve the column capacity and ductility behavior [3,4]. Due to the development of construction of a large number of highway and railway bridges, and because of lack of maintenance and standards, many old bridges has become unsatisfied the current traffic volume and load age of vehicles and most of the bridges come within highly risk. So its need to develop a new application would lead to improve the effective strengthening technique of bridge.

Some of standard and guidelines report has been published recently for the design purpose and strengthening structural element such as confined reinforced columns using FRP [5, 6]. The wrapping with FRPs has become

widely used and known well with special technique for column strengthening. Most researches used FRP-confined concrete column have been applied on reinforced or unreinforced, small scale, circular concrete cylinders or short column loaded under concentric.

In last decades, SFRP sheets have given a wide attention by the researchers, interest for confinement applications due to the significant improvement to the RC columns compared to the conventional FRP sheets [7–10].

FRP composites possess several advantages over steel, which are excellent in strength comparing with weight and have significant corrosion resistance. The major structural use of FRP in infrastructure projects almost based on the using of these advantages. FRP have been approved as a material with high tensile strength, can generally be used because of its greatest advantages, when compared with concrete which is strong in compression but poor in tension. Therefore, the use of FRP in concrete structures has been a major target of existing research [11-13].

The disadvantage of FRP confinement or jacketing columns should be addressed carefully. The special technique to perform the FRP need skill labour especially the prestressed laminate of FRP. The adhesive material using in attached the layer still have some defect when expose to sever environmental parameters , while the